

REMARKS

By this amendment, Applicants have amended the claims to delete the reference numerals therefrom and to eliminate the phrase "such as" which the Examiner deemed indefinite. Applicants have also added dependent claim 14 defining a further aspect of the present invention. See, e.g. the sentence bridging pages 9 and 10 of Applicants' specification.

In view of the foregoing amendments to the claims, it is submitted all of the claims now in the application comply with the requirements of 35 U.S.C. 112, second paragraph. Therefore, reconsideration and withdrawal of the rejection of claims 1-13 under 35 U.S.C. 112, second paragraph, are requested.

Claims 1, 2 and 5-10 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,453,727 to Lenormand et al. in view of U.S. Patent No. 4,253,327 to Wiley. Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to a method and device for evaluating physical parameters of a fragmented porous medium from rock fragments taken in this medium. The method comprises a stage of immersing fragments contained in a containment chamber in a liquid and of intermittently communicating the chamber containing the fragments with a source of liquid under pressure comprising an accumulator containing an elastic volume of liquid, so as to compress the gas trapped in the pores of the rock; a stage of measuring the volume of liquid injected; a stage of modeling the evolution of the volume of liquid injected from a priori selected initial values at least for permeability and the residual gas saturation; and a stage of iterative adjustment of the value of the physical parameters of the rock fragments so

as to obtain the best possible adjustment of the modeled evolution of the volume injected with the measured evolution of the volume injected in the chamber.

According to the present invention, during the stage of immersion, in the liquid, of the fragments contained in the containment chamber, the volume of liquid injected is measured by measuring the concomitant pressure variation in the accumulator.

Likewise, the device of the present invention includes pressure measuring means for measuring pressure variations in the accumulator such that the processing system of the device is suited for calculation of the volume of liquid injected in the chamber from the accumulator, from the pressure variation measured by the pressure measuring means.

The patent to Lenormand et al. discloses a method and system of evaluating physical parameters such as the absolute permeability of porous rocks of a zone of an underground reservoir, from fragments taken from this zone, such as rock cuttings carried along by the drilling mud. According to Lenormand et al., rock fragments (F) are immersed in a viscous fluid contained in a vessel (1). Pumping means (2, 3) first inject into vessel (1) a fluid under a pressure that increases with time, up to a determined pressure threshold, so as to compress the gas trapped in the pores of the rock. This injection stage is followed by a relaxation stage with injection stop. The pressure variation measured by detectors (7, 8) during these two successive stages is recorded by a computer (9). The evolution of the pressure during the injection process being modelled from initial values selected for the physical parameters of the fragments, the computer adjusts them iteratively so as to best get the modelled pressure curve to coincide with the pressure curve really measured.

As recognized by the Examiner, the Lenormand et al. patent does not disclose an accumulator containing an elastic volume of liquid, so as to compress

the gas trapped in the pores of the rock and, does not disclose that, during the stage of immersion in the liquid, of the fragments contained in the containment chamber, the volume of liquid injected is measured by measuring the concomitant pressure variation in the accumulator.

The Examiner cites the patent to Wiley as showing an accumulator containing an elastic volume of liquid. In particular, the Wiley patent discloses that the permeability of a rock formation is determined at elevated pressures and temperature by heating a core sample taken from the rock formation and a fluid which is utilized to determine the permeability of the core sample to an elevated temperature. The fluid is injected under pressure and a second pressure which is higher than the injection pressure is applied to the surface area of the core sample. The effect of injecting a fluid such as a corrosion inhibitor or a polymer useful in secondary or tertiary recovery techniques on the permeability of the rock formation can be determined at elevated pressures and temperature by comparing the permeability of the rock formation before the fluid is injected and after the fluid is injected.

While the Wiley patent does indeed disclose the use of a free piston accumulator filled with a pore fluid, the Wiley does not disclose that the volume of liquid injected is measured by measuring the concomitant pressure variation in the accumulator. Similarly, the Wiley patent does not disclose a device including pressure measuring means for measuring pressure variations in the accumulator. In Wiley, the variation measured from pressure gauges 28 and 36 is the pressure gradient in atmosphere of the cell. This is not the variation of the pressure into the accumulator, as presently claimed. Thus, the Wiley patent does not remedy the basic deficiency noted above with respect to Lenormand et al.

Moreover, Wiley describes a method for measuring the permeability on a core sample and not on rock fragments. The method of Wiley works only on core sample (see for example column 3, lines 29-35) as the measure of the permeability is based on the formula (1) which necessitates the dimension of the core : A and L . This is specified in column 2, lines 63-64, or more specifically column 5, lines 13-18.

Therefore, one of ordinary skill in the art would not have used the teachings of Wiley to solve the technical problem solved by the claimed method and device. In addition, the problem solved by Wiley is to take into account the in-situ conditions (column 2, lines 7-10 or lines 24-27 for example), and to determine the effect of injecting a fluid on the permeability (see column 1, lines 10-15 for example). These are not the problems solved by the invention.

Accordingly, the presently claimed invention is patentable over the proposed combination of Lenormand et al. and Wiley.

Claims 10 and 11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lenormand et al. in view of Wiley, and further in view of U.S. Patent No. 4,699,002 to Rockley. Applicants traverse this rejection and request reconsideration thereof.

The Examiner cites the Rockley patent as disclosing a powdered pycnometer. However, clearly nothing in Rockley remedies the basic deficiencies noted above with respect to Lenormand et al. and Wiley. According, claims 10 and 11 are patentable over the proposed combination of references.


Applicants note the indication of allowable subject matter in claims 3, 4, 12 and 13. In view of the foregoing amendment and remarks, it is submitted that all of the claims now in the application are in condition for allowance.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all of the claims now in the application are requested.

To the extent necessary, applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (Case: 612.43694X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



Alan E. Schiavelli
Registration No. 32,087

AES/at
(703) 312-6600